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The author has no doubt that electricity, which accompanies each radiation, acts positively under the influence of the one, and negatively under that of the other, without changing the chemical compound; in the one case this influence would give the affinity for mercury, and in the other it would destroy it.

3. "On the Value of Absolute Alcohol in Spirits of different Specific Gravities." By George Fownes, Esq., F.R.S., Professor of Practical Chemistry in University College, London.

Having been recently engaged in a series of experiments on the fermentation of sugar and molasses, which rendered it necessary to refer to a table of the value in absolute alcohol of spirits of different specific gravities, the author found himself compelled to construct for this purpose a new table, which he lays before the Royal Society in the present paper.

The table was formed by weighing out absolute alcohol and distilled water in fixed proportions, mixing them, and after allowing time for condensation, determining with suitable precautions the specific gravity of each mixture at the temperature of 60° Fahrenheit. Each alternate number in the table was so obtained; the rest being interpolated. The alcohol employed was prepared by digesting the strongest rectified spirit, first with dry carbonate of potash and afterwards with powdered quicklime and distilling. It had the specific gravity .7938 at 60°, and boiled at 177° Fahr.

The table is followed by a diagram for the purpose of contrasting the actual specific gravities found by experiment with the calculated mean specific gravities of the various mixtures of alcohol and water, in which the specific gravities are indicated by horizontal lines and the proportions of the two liquids by vertical lines. The mean specific gravities of course run straight across the diagram from corner to corner, while the actual specific gravities form an irregular curve with upward convexity, rising rapidly to near its maximum deviation at 30 per cent., proceeding nearly parallel with the other line to 50 per cent., and thence declining until it reaches the extremity of the scale.

4. "On the existence of alternating diurnal Currents of Electricity at the Terrestrial Surface, &c., and their connection with the Diurnal Variation of the Horizontal Magnetic Needle." By W. H. Barlow, Esq., M.I.C.E. Communicated by Peter Barlow, Esq., F.R.S., &c.

The observations recorded in this paper were undertaken in consequence of certain spontaneous deflections having been noticed in the needles of the Electric Telegraph on the Midland Railway. The telegraph is constructed on the principle patented by Messrs. Wheatstone and Cooke, and the signals are made by deflecting a magnetic needle placed in a coil, to the right or left, by means of a galvanic battery. It was observed that when no signals were passing, and when the wires of the telegraph had simply connexion with the earth at the two termini, spontaneous deflections, differing

in amount and direction, occasionally occurred. It was also observed in the four principal lines of telegraph which unite at Derby as a centre, two of which proceed in a northerly direction to Leeds and to Lincoln, and two in a southerly direction to Birmingham and to Rugby, that the relative deflections of the four instruments were such as to indicate that when the current of electricity, which produced the deflection, flowed from Rugby northwards towards Derby, it was also flowing northwards in all the other three; and likewise, that when it flowed southwards in one, it flowed southwards in all; the times of the deflections being simultaneous or nearly so. There appeared to be no regularity as to the hours, either during the day or night, at which these deflections occurred. Atmospheric electricity also affected the instruments, but in general only by sudden and violent effects during thunder storms, sometimes reversing the poles of the needles contained in the coils, and sometimes fusing the wire of the coil itself. But the effects first mentioned appeared to arise from a different cause; and from the great extent of line affected simultaneously by currents in the same direction, it appeared impossible they could arise from local atmospheric influences. On the night of Friday the 19th of March, there appeared a brilliant aurora, and during the whole time of its remaining visible, rapidly alternating deflections were exhibited in the telegraph instruments.

The occurrence of these phenomena induced the author, with deflectometers of very delicate construction, to make a series of experiments, from which the following results were deduced. Wires insulated throughout, and wires having only one connexion with the earth, produced no deflection; and a complete circuit made by uniting both extremities of two wires, each forty-one miles long, but insulated throughout, produced no deflection. In every case, however, a deflection was obtained on a wire having both ends connected with the earth, which deflection was continually varying in amount and sometimes in direction.

On making a series of observations every five minutes for twenty-four hours, at both extremities of a wire, from Derby to Birmingham, it was found that the changes, both of amount and direction, occurred simultaneously at the two ends, and that the current flowed from one end communicating with the earth to the other. The examination of this series of observations showed a general direction of the needle to the right from noon till near midnight, and then to the left until between nine and ten A.M., when it again changed to the right. In consequence of this apparent regularity, the experiments were carefully followed up at Derby for a fortnight on the two telegraphic wires proceeding from Derby to Rugby and Birmingham. These experiments showed that the electric current was subject to a regular diurnal alternation, the times of zero agreeing nearly with the known times of zero of the variation of the magnetic needle; and also that the deflection to the left corresponded with easterly variation, and the deflection to the right with westerly variation; the path described by the needle of the deflectometer

being by no means steady and uniform, but subject to alternating changes of greater or less amount. The effects exhibited on these wires, and which, from the experiments, were found to occur on the north of Derby as well as on the south, would be accounted for by supposing that they were caused by alternating currents of electricity on the earth's surface in a northerly and southerly direction, proceeding towards the north until 9 A.M., and towards the south until from 7 to 12 P.M., and then again turning northwards; agreeing, therefore, nearly in point of time with the usual times of daily change in the direction of the magnetic needle. The experiments, as has been stated, were continued during a fortnight, and the deflection noted every five minutes, day and night. The paper contains the tabular records of these observations; and also diagrams are given exhibiting the daily path of the needle.

The author concludes his paper by expressing his regret that his avocations do not allow him sufficient leisure to prosecute this inquiry, but that he will be happy to place in the hands of any person desirous of pursuing the subject all the tables and results which he has collected.

5. "On the Direction assumed by Plants during their growth." By Professor Macaire, of Geneva. Communicated by P. M. Roget, M.D., Sec. R.S., &c.

This paper is divided into three sections.

The first section contains an account of some observations and experiments made by the author on the phenomena of the curling of the tendrils of the *Tamus communis*. After a description of the tendril, which in this plant is the footstalk of an abortive leaf, the author shows that the contractile power of the organ is excited by contact with any object whatsoever, and even with another part of the same plant; that the curling begins at the point of contact, but continues in both ends of the tendril, either forming knots, if there be something to embrace, or taking the shape of a cork-screw, if there be not. The knots are completed in a few minutes, and exert a considerable degree of pressure. A separation from the plant stops the curling up of the tendril. The curling always takes place in the same direction from the outside inwards. When the tendril is immersed in water, or in a solution of gum, it does not contract; but at the same time it does not lose the faculty of curling up by contact with a solid body. Ammonia, alcohol, or Eau de Cologne have little or no effect. Diluted sulphuric and nitric acids, even the vapours alone of the last, without actual contact, immediately excite in the tendril an energetic contraction. The same thing happens with a solution of corrosive sublimate. On the contrary, prussic acid stops the curling up that had already begun, and renders the tendril incapable of being again excited by the contact of a solid body.

The conclusions which the author comes to on this subject are, that the contractions of tendrils cannot be explained by the hypotheses of Knight and De Candolle of an unequal action of light on